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NEW PAPILIONOIDEA AND HESPERIOIDEA FROM NORTH AMERICA

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Introduction. I have been preparing a field guide to the North American butterflies for several years. This book does not treat every subspecies and variation found in the North American butterflies, but it does treat the major subspecies and forms. Some of these are not named, so I am naming them at this time to make the names available for the book.

Methods. A brief description and diagnosis is given for each name. Types are designated, and are deposited in the Los Angeles County Museum (the holotypes at least) unless otherwise stated. Types are not designated for forms because the International Code of Zoological Nomenclature no longer recognizes them; the form names are proposed only for convenience in description. Many forms, such as the ones involved in mimicry, or the seasonal forms involved in climatic adaptation, have real ecological or genetic significance. Most named subspecies will be illustrated in the forthcoming book.

Papilio glaucus form nigra. The black female form of glaucus L. common in SE U.S. is involved in mimicry and has been studied often. The type of glaucus was actually the black form. Referring to the black form of a normally yellow insect as form glaucus is a nuisance, however, and very few people have done so. For convenience I refer to the black female form as form nigra.

Papilio polyxenes kahli form comstocki J. Scott & J. Troubridge. Jim Troubridge reared several hundred kahli C. & C. from Zizia aptera (Umbelliferae) in the Duck Mts. & Riding Mts. Manitoba. All produced various varieties of black forms, except one female which is a yellow form (the VHW is yellow from the median to the base of the wing). The upperside median yellow band is only about 7 mm wide on DFW and 1.2 cm wide on DHW (the wing bases are black), narrower than most yellow forms, so by analogy with the same form in P. polyxenes coloro Wright (=rudkini Comstock), we call it form comstocki. C. Remington reared 1 m 1 f comstocki from fairly wide banded heterozygous black form kahli parents (1958 Int. Congr. Entom. #10, Proc. 2:803). P. machaon hudsonianus Clark has a form avinoffi C. & C. with narrower yellow median bands (at least on the fw of the male type), but machaon feeds only on Compositae in North America (Petasites frigidus var. palmatus in Sask.). Further rearing of hudsonianus will be necessary to determine the variation of avinoffi compared to comstocki. It seems clear that the origin of kahli & comstocki is the introgression of hudsonianus genes into P. polyxenes. The 1979 News of the Lepidopterists' Society (#3 p. 5) reported a male "kahli" from Cochrane Ontario, 24 May 1958, coll. O. D. Boggs, now in the Royal Ontario Museum. This specimen has nothing to do with kahli, which is a ssp. of polyxenes with the abdomen black with three rows of yellow dots. From the range, it might be considered a form of hudsonianus. However, the wing pattern is that of nitra Edw., Jim Troubridge degreased the abdomen & found it has one lateral row of yellow dots like nitra, and J. Riotte states that Boggs was an Alberta collector. Obviously the specimen was collected at Cochrane Alberta where nitra flies, and mislabeled Ontario.

Papilio zelicaon forms comstocki and ampliatanitra. Form nitra of zelicaon Lucas is the black form (see Fisher 1977), characterized in general by one lateral

row of yellow dots (rarely a few tiny dots in a subdorsal row) on the abdomen; it may have slightly yellow or black tegulae, and a few to some orange median ventral hindwing spots. Like the black forms of every machaon-group species, the median yellow bands vary in width, from up to about 8 mm wide on DHW, to nearly absent. The band width varies continuously. I caught a wild male with very narrow bands in 1981 and paired it with a reared zelicaon female. Some offspring were yellow zelicaon and others were form nitra, showing that the male parent was heterozygous. Some nitra offspring were as dark as any P. polyxenes form ampliata; I call these very narrow banded individuals form ampliatanitra. Many form zelicaon females from this cross also had narrow bands, like P. polyxenes coloro f. comstocki. The yellow form with narrow DHW median band I call form comstocki; forms comstocki & ampliatanitra occur in nature, but are uncommon. One male from the above cross has three rows of abdomen dots like polyxenes and would be identified as polyxenes if caught in nature. Oddities like this male, plus the numerous wild specimens showing every degree of intermediacy between nitra & polyxenes, plus the proven ability of polyxenes & zelicaon to mate in nature (I observed a completed courtship and mating), plus Clarke & Sheppard's finding that F_1 and backcrosses are viable in the machaon group, leads me to the conclusion that zelicaon & polyxenes may be merely polymorphs rather than distinct species.

Papilio bairdii forms ampliata & comstocki. P. bairdii Edw. is very variable in southern Colo. The yellow form brucei Edw., which has the VHW yellow from base to middle, is about 27% of the population. Black forms with black VHW base are about 73% of the population. The abdomen of black forms varies continuously from black with 2-3 rows of yellow dots, to the same with yellow suffusion between the yellow dots (form hollandii Edw.). The upperside median bands vary from wide (1 cm on DHW) to nearly absent in the black forms. The form with median band nearly obsolete I call ampliata after the same form in P. polyxenes. Hollandii has occasionally been applied to the wide wing band form, because the type had a yellow abdomen and 1 cm. wide wing bands, but Edwards' usage of the name in his publications indicates that the yellow abdomen is the diagnostic trait of hollandii. Width of the yellow bands on DHW and forewing varies in the yellow forms also; I call the yellow form (with VHW base yellow) that has narrow (1 cm) DHW median yellow bands form comstocki, after the same form in P. p. coloro.

Neophasia menapia melanica Scott, new subspecies. There is a ssp. of menapia Felder & Felder on the outer Coast Range of Calif. in Sonoma & Mendocino Cos. which is very distinctive that I call melanica. The forewing black submarginal band is broader, about 5-6 mm wide (about 3-4 mm in menapia) and is only 2-3 mm from the end of the discal cell in most specimens (5-6 mm in ssp. menapia). The black bar at the end of the forewing discal cell is narrower, being a linear black dash rather than expanded into a club as in ssp. menapia. The hindwing is like ssp. menapia although the submarginal black band seems slightly thicker toward the apex in ssp. melanica. Holotype male 6 mi. W. Willits, Mendocino Co. Calif., 30 June 1951, W. C. Bentinck, in California Insect Survey, Berkeley, Calif. Allotype female and 8 m 1 f paratypes 12 mi. W. Willits, Mend. Co. Cal. 13 July 1964 J. Scott. 1 male paratype Guerneville, Sonoma Co. Calif. 14 June 1966 R. A. Belmont, in J. Scott collection with the allotype & other paratypes. This subspecies is not tau Scudder which was named from Washington Territory somewhere along the shore of the Straits of Georgia. Tau is a synonym of menapia. It is not suffusa (Stretch), type locality "vicinity of Spokane Falls Washington." It is not nigracosta Comstock, type locality near Olancha Peak, Tulare Co. Cal. Marsupia Hagen 1882 (Can Ent. 14:177) is a gross misspelling of menapia, and applies to Washington material. Dr. F. M. Brown informs me that menapia was actually collected in the pine forest just west of Pyramid Lake Nevada, not at

Salt Lake in Utah, which its collector did not visit. Dr. Brown also informs me that "ninonia (Bdv.) and menapia are straight synonyms probably based on the same lot collected by Lorquin." So none of these names apply to melanica, and all of them are synonyms of menapia I think, although nigracosta and possibly suffusa are aberrations of ssp. menapia. Typical N. m. menapia occurs in the Inner Coast Range at 3 mi. N. Adams, Lake Co. Calif. (6 July 1968 2 m 1 f J. Scott), at Plaskett Meadows 6200', Glenn Co. Calif. (3 July 1960 1 m J. A. Powell), at Little Doe Cgd., Mendocino Co. Calif. (11-13 Aug. 1975, J. A. & J. M. Chemsak), at Scott Bar, Siskiyou Co. Calif. (20 July 1951, 1 m R. P. Allen), at 1 mi. NW Weott, Humboldt Co. Calif. (23 Aug. 1969, J. Powell), in Trinity Co. Calif. (1 m 5 July 1931) (most of these specimens are in California Insect Survey), and throughout the Sierra Nevada, Oregon, and the rest of the west. I observed oviposition on Pseudotsuga menziesii W. of Willits, and Ron Leuschner found melanica associated with menziesii in Sonoma Co. Cal. Leuschner found a population intermediate between menapia & melanica at 2 mi. N. Angwin, Napa Co. Cal. associated with Pinus ponderosa. Male and female genitalia are similar in the two subspecies; in some males of both ssp. the uncus is reflexed down & forward, apparently due to curvature upon drying.

Kricogonia lyside (Godart) female form anorbus. Lyside is very variable. It used to be called castalia (Fab.) but that name applies to the Jamaican ssp. of Appias drusilla (Cramer). Male lyside may have a black HW bar (form terissa (Lucas)) and always have a yellow FW base. Females may be solid yellow (form unicolor Godman & Salvin) or white, the forewing may have a brown border (form fantasia Butler) or lack it, and the forewing base may be yellow or white. These female traits vary independently. The female form with no yellow at base I call anorbus. It is noticeable in the white wing form, but the genes responsible for it may be present in some unicolor females also.

Appias drusilla (Cramer) female form amarilla. The female form peregrina Rober is white on the upperside with the hindwings slightly yellowish and the forewing brown margin narrow. Female form amarilla is the same but the forewing brown margin is broader and the hindwing upperside is more yellow.

Ascia monuste (L.) female form nigra. The name phileta (Fabricius) applies to the dark gray female form, but it is usually applied to the Florida subspecies of monuste rather than the form, so to avoid confusion I call the dark gray female nigra. Roger Pease Jr. found that long photoperiod produces nigra.

Phoebis philea (Johansson) forms alamacho and crema. Females vary from yellow with wide red DHW margins and a very broad orangish DFW spot (broader than the male's spot)(form alamacho), to uniformly cream colored on both wings without any red or orange (form crema).

Phoebis statira (Cramer) female form naranja. Females are variable, from white (form stabla Brown) to yellow (form butleri Scudder) to orange. The orange female I call naranja.

Danaus plexippus form alba. Albino plexippus (L.) are unknown on mainland North America, but are persistent though uncommon in Hawaii. This albino form that I call alba evidently arose from inbreeding in the small number of immigrants founding the Hawaiian population, perhaps only one female.

Erebia callias form sinocho. E. callias Edw. normally has two forewing ocelli forming a figure-eight pattern in the red patch. Colorado individuals always have the ocelli, but in northwestern Wyoming occasional individuals lack them, a form I call sinocho. E. epipsodea Butler also occasionally lacks the ocelli in one colony in Summit Co. Colo. (form brucei Elwes); William Henry Edwards raised normal epipsodea from brucei eggs a hundred years ago. The ocelli vary continuously in both species from normal size to absent, and they tend to be larger on the underside (so are occasionally small on underside & absent on upperside), so inheritance of ocelli may be due to nondominance, to multiple alleles, or due to several pairs of genes.

Erebia rossii (Curtis) form anocellus. This form also lacks ocelli. It is rare or absent in most places but it is fairly common in the Boothia Peninsula NWT.

Euphydryas chalcedona hennei Scott, new subspecies. Hennei was known as E. c. quino (Behr), but John Emmel informs me that quino actually applies to E. editha (Bdv.), and both editha augusta (Edw.) and editha wrighti Gunder are synonyms of quino, leaving the chalcedona ssp. without a name (furthermore, the San Bernardino Mts. red populations formerly called augusta now lack a name, and must be called augustina Wright). Hennei Gunder was named based on an aberration, and the Code of nomenclature is interpreted by many to make aberrations unavailable. Therefore I now call the subspecies hennei. This will satisfy taxonomists as to the name hennei, although some arguments may persist as to whether Gunder or Scott named the subspecies. E. c. hennei occurs at the west edge of the Colorado Desert in San Diego & Riverside Counties Calif., and differs from the adjacent ssp. chalcedona (Doubleday) in the increased extent of white dorsal markings. The upper prong of the valval process also tends to be longer, and the lower prong of the valval process is frequently bifurcate (Scott 1978). Emmel & Emmel (1973) figure the ssp. as quino. Types, all San Diego Co. Calif. In California Insect Survey: Box Canyon 30 March 1962 M. J. McKenney male holotype & female allotype, 30 March 1952 3 male paratypes, 22 March 1953 1 male paratype J. A. Powell, 8 April 1952 5 male paratypes J. Powell, 28 March 1953 1 paratype. In Los Angeles County Museum Natural History: Tecate Mtn. 9 April 1961 1 male O. Shields, 9 May 1959 1 male O. Shields; 1/2 mi. N. of Cuyamaca Lake 17 June 1961 1 male O. Shields; La Mesa 18 April 1919 O. Sette 6 male 2 female; 3 mi. N. of Scissors Crossing 1 Feb. 1958 O. Shields 1 male; 1 mi. W. Scissors Crossing 12 March 1960 O. Shields 2 male; 3 mi. W. Jacumba 20 March 1960 O. Shields 8 male 9 female, 26 March 1960 1 female, 19 March 1961 1 female; El Cajon (all O. Shields) 12 April 1958 2 female, 31 May 1958 1 male, 27 April 1959 4 male 2 female, 29 April 1959 1 female, 2 May 1959 1 female, 7 May 1959 2 female. In J. Scott collection: 3 mi. W. Jacumba 26 March 1960 3 male 5 female, 29 March 1960 1 male, O. Shields; Jamul ex. larva 21 March 1962 O. Shields 1 female; N. side Devil's Canyon 7-10 mi. E. Jacumba 5 April 1966 J. Snider 5 male 1 female.

Speyeria atlantis ratonensis Scott, new subspecies. Among the palest ssp. of atlantis, as pale as Nevada greyi Moeck and Canada dennisi (Gunder). The VHW disc is pale brown, varying from pale to dark reddish brown, with pale yellow patches frequent in the disc making it appear pale brown. None of the individuals are as dark as the disc of nikias (Ehrmann) or electa (Edw.) although a few individuals approach them. The VHW submarginal band is pale yellow. The VFW is pale orange on the basal two thirds of the wing. The upperside is pale orange with the wing bases brown in the basal third. The dorsal wing bases are much lighter than those of electa or nikias. The dorsal wing margins are orange but are brown on the forewing in some females. The upperside is like dennisi but the black lines are slightly wider (almost as wide as electa, narrower than greyi). The black dot at base of forewing cell Cu_2 is usually present (often absent in dennisi, present in greyi). Ratonensis is similar to greyi except that the ventral hindwing silver spots are much larger in greyi than in ratonensis & dennisi. The ventral hindwing spots are always silvered in ratonensis, greyi, & dennisi. This is surprising in itself because unsilvered forms are frequent in the Sangre de Cristo Mts. to the west of ratonensis, and they nearly surround greyi. I think ratonensis is a Pleistocene relict related to dennisi. During the last glaciation the two pale populations were connected and present in mixed grassland & aspen forest on the southern plains, and when the climate warmed dennisi advanced north to Canada while ratonensis moved upward to mesa tops. Another butterfly, Oeneis alberta, is also present in the Canada prairie and on Raton Mesa. The wider black dorsal lines of ratonensis are apparently due to immigrants from the mountains to the west, while the mainly grassland habitat has maintained the overall pallidity.

The range is limited to Raton Mesa in northeastern New Mexico. Holotype male & allotype female Raton Mesa, Colfax Co. New Mex. 21 July 1972, J. Scott. 95 paratypes Raton Mesa 21 July 1972, 4 July 1973, 24 Aug. 1979, 21 Aug. 1980 all J. Scott, 27 Aug. 1980 G. Scott, 2 July 1980 L. P. Grey. (8 paratypes New Mex. SU).

Boloria titania (Esper) sangredecristo Scott, new subspecies. This ssp. is distinguished by its sexual dimorphism. Females have broader brown stripes on the upperside wing veins, and seem to have darker wing bases; the overall female appearance tends toward that of B. napaea (Hoff.) females, because of the broad wing veins and because females are a little paler than males (the upperside is yellower orange). Ssp. helena (Edw.) from the Colo. Front Range and San Juan Mts. has females bright orange like males with narrow veins like males. Holotype female and allotype male Hermit Pass, Sangre de Cristo Mts., Custer Co. Colo. 23 July 1970 J. Scott. Paratypes: Hermit Pass 13000' 20 July 1968 Glenn Scott 3 m, 22 July 1968 3 m 5 f G. Scott, 23 July 1970 16 m 7 f J. Scott, 31 July 1970 4 m 1 f J. Scott, 1 Aug. 1971 6 m J. Scott; Baldy Peak 12500' Custer Co. Colo. 29 July 1970 3 m 2 f J. Scott. It also occurs at Hunts Lake 11400' & South Colony Lake in the Sangre de Cristo Mts. 3 females from West Creek Lake in Fremont Co. seem intermediate to ssp. helena, in the extreme northern Sangre de Cristo Mts. It occurs at or above timberline. Five females seen from Wheeler Peak in the Sangre de Cristo Mts. of New Mexico are ssp. helena, not sangredecristo. It is interesting that females similar to sangredecristo occur on the Beartooth Plateau of Wyo. & Mont.

Asterocampa clyton (Bdv. & Le C.) form apunctus. The ventral hindwing is usually marked with white bands & spots, but sometimes it is uniform grayish with bands & spots very faint (form apunctus). The genetic or environmental origin of this form has not been determined.

Satyrium calanus albidus Scott, new subspecies. The underside is much paler than other calanus (Hubner) ssp. The underside is pale brown in males, pale tan in females (in ssp. godarti (Field) and other ssp. it is brownish black in males, brown in females). Form heathii (Fletcher) is frequent in ssp. albidus in Routt Co. Colo., along with numerous intergrades to it, but the entire population is paler than godarti. It occurs on the western slope of the continental divide in Colorado from Routt to Delta Counties. Types: NW Hayden, Routt Co. Colo. 10 July 1972 holotype male, 7 m paratypes. Crystal Creek, 8000', Montrose Co. Colo. 30 July 1972 allotype female, 6 m 14 f paratypes. Just N. Glenwood Springs, Garfield Co. Colo. 19 June 1972, 1 m paratype.

Celastrina argiolus ladon form lucimargina. The spring generation of argiolus (L.) ladon (Cramer) is very variable. Form lucia (Kirby) has a blackish blotch in the middle of VHW, form marginata (Edw.) has heavy black marginal marks on VHW, and form violacea (Edw.) has neither of these (having tiny black dots in center and on margin). The form with both a central blackish blotch and heavy marginal black marks has never been named; I call it lucimargina. All these forms fly together in ssp. ladon in northeastern U.S. and the Rocky Mts. at least from S. Alberta south to the San Juan Mts. & Boulder Co. Colorado, yet their genetics has still not been studied because of the difficulty of overwintering the diapausing pupae.

Everes amyntula form immaculata. On the west coast, and occasionally in the Great Basin, occasional individuals have the ventral spots reduced or even some spots absent (form immaculata). This variation seems best treated as a form, although it is the usual form in some places in Oregon etc. The subspecies named in amyntula (Bdv.) all seem rather worthless; this form is the major variation.

Euphilotes spaldingi pinjuna Scott, new subspecies. This subspecies differs from Ariz. & Utah ssp. spaldingi B. & McD. in having darker ventral wing surfaces, and in having the red band as wide on ventral hindwing as on ventral forewing. It occurs in Colo. & New Mex. Named from its habitat which has many Juniperus, many Pinus edulis trees, some P. ponderosa, and Cercocarpus bushes. Types: Shilling's Spring, Conejos Co. Colo. 9 July 1967 73 m 9 f (holotype, allotype, & paratypes); Terrace (Alamosa) Res., Conejos Co. Colo. 8 July 1967 5 m, 9 July 1967 23 m 1 f paratypes; all coll. J. Scott, Glenn Scott, Kathleen Scott, Juanita Scott.

Plebejus lupini male form transvestitus. Carll Goodpasture (1973) found that genitalically, P. acmon (Westwood & Hewitson), lupini (Bdv.), and neurona (Skinner) are distinct in California where they seldom intergrade. However, he notes that in areas where lupini & neurona fly together, occasional female lupini have orange forewing borders like neurona, and occasional male lupini have the blue less dense or even absent. These brown male lupini (which Goodpasture found on Mt. Tehachapi in Kern Co. Calif.) I call form transvestitus because of their female appearance. It and the orange-forewing females evidently arose from introgression due to occasional hybridization between lupini & neurona. Goodpasture also notes that lupini & acmon hybridize in Nevada, Oregon, & Washington.

Lycaena cupreus artemisia Scott, new subspecies. In the Rocky Mts. there are two subspecies of cupreus (Edw.). Above timberline (ssp. snowi (Edw.)) adults are shining brassy orange and are dark gray on underside and the dorsal hindwing is often dark especially in females. The VHW has the submarginal red band composed usually of a few dashes near the tornus, and there are black spots on the margin in cell Cu_2 and black submarginal cones near the apex. The Calif.-Ore. ssp. cupreus in contrast is shining red, the ventral hindwing is mostly pale cream (light gray at the base), and the dorsal hindwing is never dark (the anal margin is dark in all ssp.). The ventral hindwing has the submarginal red band with many dashes from tornus to cell M_1 or M_2 (rarely M_3), black spots are lacking on the cell Cu_2 margin, and black submarginal spots are limited to a few rectangular dashes near the apex. Below timberline (ssp. artemisia) in Canadian Zone Rocky Mtn. habitats and in the Great Basin, usually in sagebrush habitats, adults vary from shining brassy orange to shining red (usually shining reddish orange, but many females are pale yellow orange), the DHW is suffused with brown in many but not all females, and the VHW varies from pale creamy gray (usually) to rarely dark gray. The VHW submarginal red band is usually short like snowi and the submarginal black spots are like snowi but on the average are less conical, and the marginal spots in cell Cu_2 are like snowi but they are usually thin or nearly absent. Ssp. artemisia is in general intermediate between snowi & cupreus in wing pattern, although the upperside black spots of male artemisia are larger than those of either snowi or cupreus (for instance the forewing cell Cu_2 postmedian black spots are usually present in male artemisia but usually absent in snowi & cupreus). In habitat artemisia is closer to cupreus which is a Canadian & Hudsonian Zone ssp. seldom

occurring in the alpine zone of the Sierra Nevada Mts. (the alpine White Mts. Cal. population is like cupreus but the black spots are a little larger and the upperside slightly darker). Alpine Alberta populations are most like snowi but the ventral hindwing submarginal & marginal black spots are like artemisia (the spots on cell Cu$_2$ margin are often absent). Types: holotype male & allotype female The Potholes, Teton Co. Wyo. 19 June 1962 (& 20 m 2 f paratypes), 18 June 1962 1 m 2 f paratypes, J. Scott & G. Scott; other paratypes Taggart Lake Trail Teton Co. 18 June 1962 2 m 1 f J. Scott & G. Scott; 1 mi. S. Jenny Lake Teton Co. 18 June 1962 15 m 1 f J. Scott & G. Scott; Red Canyon Creek, near Hebgen Res., Mont. 26 July 1962 1 f William Cobban Jr.; Doubletop Mtn., Wind River Mts. Wyo. 9 Aug. 1980 2 m J. Scott; Halfmoon Park, Crazy Mts. Mont. 27 June 1966 1 m 1 f and 4 July 1966 2 m 3 f J. Scott; holotype & allotype in LACM, some paratypes in Denver Museum of Natural History, most paratypes in J. Scott coll.

Thorybes mexicana blanca Scott, new subspecies. Blanca is like ssp. mexicana (Herrich-Schaffer) (=nevada Scudder) on the upperside, but differs on the underside in that the light fine striations are whiter, making the appearance much whiter over most of the VHW and the apex of VFW. The wing fringe is also lighter on both surfaces. The other named ssp. of mexicana I think are synonyms: nevada & aemilia (Skinner) look like Mexican (Chihuahua) mexicana to me, and dobra Evans is merely an aberration with small forewing hyaline spots. Blanca seems restricted to the White Mts. of Calif. & Nevada, 7500' to above timberline, although occasional individuals from the southern Sierra Nevada (one male from Sonora Pass for instance) are like it. Types: Crooked Creek lab, 10150', 3 airline mi. N. Inyo Co. line, Mono Co. Calif. 28 June 1961 J. A. Powell (holotype male & allotype female), and 6 paratypes from this locality on 23 June 1961 G. Frankie 1 m, 22 June 1961 D. Miller 1 f, 23 June 1961 1 m and 24 June 1961 1 f both J. Powell, 4 July 1961 1 m D. Rentz, 11 July 1961 1 f W. A. Foster. Mt. Barcroft lab, 12500', Mono. Co. Cal. 5 July 1961 1 m 4 f paratypes. These types are all in California Insect Survey. Mt. Barcroft, White Mts. Cal. 21 July 1974 J. Scott, 7 m paratypes in J. Scott collection.

Pyrgus ruralis lagunae Scott, new subspecies. The white markings are greatly extended making the overall appearance whitish rather than mostly black in ssp. ruralis (Bdv.). The male & female genitalia are like ssp. ruralis (Scott 1975). The allotype is figured by Emmel & Emmel (1973), paratypes by Scott (1975). Lagunae is the name by which it has been known, informally, for many years. It appears to be limited to the San Diego Co. Calif. mountains, from the Laguna Mts. north to Mt. Palomar, and is possibly worthy of conservationists' attention. One brood flies from mid April to early June, and a complete or partial brood flies from late June to late July. This subspecies is not caespitatis (Bdv.) 1852 from the vicinity of San Francisco or the Tuolumne gold fields (F. M. Brown pers. comm.), or ricara (Edw.) 1865 from Empire, Clear Creek Co. Colo., or petreius (Edw.) 1870 from Nevada; all three are synonyms of ruralis (Bdv.) 1852 from the same type locality as caespitatis. To fix these names more precisely I restrict the type locality of ruralis as Tuolumne Co. Calif., designate the type loc. of caespitatis as Marin Co. Calif. Types: all Laguna Mts., San Diego Co. Calif., all Los Angeles County Museum Nat. Hist. and paratypes unless otherwise stated. N. end E. Laguna, 5 May 1956, F. Thorne (1 male holotype, 1 female allotype, 2 m 4 f paratypes); East Laguna, F. Thorne 5 May 1957 4 m 6 f; East Laguna, F. Thorne 14 July 1957 15 m 2 f; Little Laguna 5500', F. Thorne 9 May 1958 3 m 1 f; Laguna L. 5500' 16 mi. SSE Julian, O. Sette, 5 June 1955 1 f; Boiling Springs 30 April 1966 O. Shields 1 m; Laguna Mts. 5 June 1957 1 m 1 f, 6 June 1956 1 f, E. Hulbirt collection in LACM; Laguna Mts. 13 April 1947 5 m 2 f, 20 April 1947 7 m 4 f, 25 April 1948 1 m, 2 May 1948 1 f, 9 May 1948 2 m 1 f, 16 May 1948 1 m, all J. Creelman; "Mountain Area" 28 June 1936 F. Thorne 1 m 1 f; Laguna Lakes 5350' 25 May 1958 O. Shields 2 m 1 f in J. Scott collection.

Pholisora alpheus texana Scott, new subspecies. Restricted to the Rio Grande valley in south and west Texas, this ssp. differs from typical alpheus (Edw.) in its generally smaller size, the generally darker upper and underside, the DFW postmedian black dashes which are sometimes less elongate and conspicuous, the conspicuous basal and medial white VHW dots, and the less VHW submarginal white. Texana is like P. a. gracielae MacNeill from the lower Colorado River area in W. Ariz.-E. Calif. on the underside, and the underside approaches it but the postmedian DFW is usually not as extreme as gracielae which has the black dashes usually not elongated. Some texana are like gracielae. The male genitalia are the same in all three ssp. It is interesting that the populations along major desert rivers converge somewhat in wing pattern. Adults are associated with Atriplex canescens in west Texas. Types: Boca Chica, 20-22 mi. E. Brownsville, Texas, J. Richard Heitzman, holotype male & 10 m 3 f paratypes 23 June 1968, allotype female 27 June 1968, 4 m 4 f 26 June 1968, 1 m 1 f 21 June 1969, 2 f 26 June 1969, 1 m 27 June 1968; Brownsville, Cameron Co. Texas J. R. Heitzman 1 m 26 June 1969; Boquillas Canyon, Brewster Co. Texas 23 Sept. 1969 J. Scott 3 m 3 f; Presidio, Brewster Co. Texas 24 June 1968 1 f John Hafernik; holotype in LACM, 25 paratypes in J. R. Heitzman coll., the remainder in J. Scott coll.

Hesperia comma (L.) oroplata Scott, new subspecies. Oroplata is discussed and figured by Scott (1975b) as H. c. ssp. (figs. 1, 3, 19, 20, 21, 22, 23). It is characterized by the yellowish VHW with a silvery chevron that forms an acute angle in males and many females. It differs from H. c. harpalus (Edwards) in the yellowish rather than often greenish VHW. It differs from H. c. colorado (Scudder) in the lighter yellowish rather than greenish brown VHW, and in slight differences in genitalia, antenna length, number of micropyle spines & developmental period (Scott 1975b). It differs from H. c. ochracea Lindsey in the yellower VHW (ochracea is often somewhat orangish ochre) and the silvery acute angled chevron (ochracea often has the chevron suffused with ochre and blunt at the apex). Ochracea is an unfortunate name because it applies to the foothills populations of the Colorado Front Range that are actually intermediate between assiniboia (Lyman) (which has the VHW orangish ochre with the band usually suffused with ochre) and oroplata; a conservative taxonomic treatment of these taxa would recognize only oroplata and assiniboia as the endpoints of the variation and sink ochracea to assiniboia. At higher altitude ochracea intergrades with colorado, and oroplata intergrades with colorado in the upper Arkansas River Canyon and western Conejos Co. Colo. (Scott 1975b). Oroplata ranges in Colorado from the Arkansas River Valley south of Buena Vista to the Royal Gorge, south to the Sangre de Cristo Mts. of New Mexico, and the San Luis Valley of Colorado. It may occur in northwestern New Mexico. The Kaibab Plateau Ariz. population is similar but has a more brownish yellow VHW. Types: holotype male Spring Creek, Fremont Co. Colo. 5 Aug. 1969 J. Scott, paratypes 15 Aug. 1965 9 m, 31 July 1969 1 m, 1 Aug. 1969 1 m, 2 Aug. 1969 3 m, 7 Aug. 1969 1 f, all J. Scott; allotype female Raton Mesa, Colfax Co. New Mexico 21 Aug. 1980, 15 m 8 f paratypes also, J. Scott, 22 Aug. 1980 1 m Glenn Scott, 24 Aug. 1979 J. Scott 3 m; Querida, Custer Co. Colo. 1 Sept. 1962 4 m 1 f J. Scott; 1 mile NE Calcite, Fremont Co. Colo. 29 July 1965 3 m J. Scott; 3 mi. SW Cotopaxi, Fremont Co. Colo. 3 Aug. 1965 2 m J. Scott; S. Fork South Falls Gulch, Custer Co. Colo. 5 Aug. 1965 1 m J. Scott; 1 mi. SE Salida, Chaffee Co. Colo. 2 Aug. 1965 2 m J. Scott; Hayden Creek Campground, Fremont Co. Colo. 10 Aug. 1965 1 m J. Scott (JAS); mouth Kuntz Gulch, Fremont Co. Colo. 2 m JAS, 26 Aug. 1970 1 f JAS; Oak Creek S. Cotopaxi, Fremont Co. Colo. 16 Aug. 1965 1 f JAS, 19 Sept. 1968 3 m 2 f G. Scott; 2 mi. NE Hillside, Custer Co. Colo. 18 Aug. 1965 2 m JAS; 1-2 mi. W. Democratic Mtn., Custer Co. Colo. 20 Aug. 1965 3 m JAS, 24 Aug. 1965 1 m JAS; gulch just S. Reed

Gulch, Custer Co. Colo. 23 Aug. 1965 1 m JAS; Sand Gulch, Fremont Co. Colo. 27 Aug. 1965 1 m JAS; Gem Mtn., Fremont Co. Colo. 30 Aug. 1968 1 f Glenn Scott; Satterly Gulch, Custer Co. Colo. 9 Sept. 1968 2 m Glenn Scott; Oak Creek Campground, Fremont Co. Colo. 2 Aug. 1970 1 m JAS; Wylie Gulch, Huerfano Co. Colo. 24 Sept. 1968 2 m 2 f Glenn Scott; Howard, Fremont Co. Colo. 26 Sept. 1968 1 f Glenn Scott; Box Canyon, Fremont Co. Colo. 30 July 1969 1 m JAS; hills SE mouth Bear Creek, Fremont Co. Colo. 7 Aug. 1969 1 m JAS; Lake Creek Cgd., Custer Co. Colo. 13 Aug. 1970 1 m JAS, 27 Aug. 1970 4 m 1 f JAS; Bull Domingo Hills, Custer Co. Colo. 16 Aug. 1970 1 m JAS; Junkins Park, Custer Co. Colo. 24 Aug. 1970 5 m 2 f JAS; 2½ mi. NE Rosita, Custer Co. Colo. 24 Aug. 1970 2 m JAS; Iron Dollar Gulch S. Cotopaxi, Fremont Co. Colo. 26 Aug. 1970 1 m JAS; Coaldale, Fremont Co. Colo. 26 Aug. 1970 1 m JAS, 15 Sept. 1970 1 f JAS; Hermit Pass Road, 8800', Custer Co. Colo. 28 Aug. 1970 1 m JAS; Promontory Divide, Huerfano-Custer Co. line, Colo. 29 Aug. 1970 5 m JAS; turnoff to Little Cochetopa Creek, near Salida, Chaffee Co. Colo. 10 Sept. 1971 1 m JAS; Spiral Drive, Salida, Fremont Co. Colo. 10 Sept. 1971 1 m 1 f JAS; Kerr Gulch, Fremont Co. Colo. 15 Aug. 1973 2 m JAS, 19 Aug. 1973 3 m JAS; N. Fork Purgatoire R., N. Monument Lake, Las Animas Co. Colo. 21 Aug. 1980 1 f JAS; Stonewall, Las Animas Co. Colo. 21 Aug. 1980 1 m JAS; 3 mi. NW Stonewall, Las Animas Co. Colo. 25 Aug. 1979 5 m JAS; Ferguson Creek, 8200', Saguache Co. Colo. 22 Aug. 1965 5 m 1 f JAS; N. Crestone Campground, Saguache Co. Colo. 2 Aug. 1967 2 m JAS; 6 mi. W. Villa Grove, Saguache Co. Colo. 21-22 Aug. 1969 1 f JAS; Medano Creek, Alamosa Co. Colo. 1 Aug. 1970 1 m JAS; Rito Alto Creek, Saguache Co. Colo. 9 Aug. 1970 6 m JAS; 7 mi. W. La Garita, Saguache Co. Colo. 14 Aug. 1970 2 m JAS. Paratypes in New Mex. State Univ., W. McGuire colls., etc.

Polites sabuleti ministigma Scott, new subspecies. This subspecies is similar to typical sabuleti (Bdv.) except for two traits: the brown patch of scales distal to the male stigma in cells Cu_1 & Cu_2 is nearly gone (nearly absent in cell Cu_1 and 1 mm or less wide in cell Cu_2; in ssp. sabuleti it is about 2 mm wide) and the stigma itself is smaller (narrower and shorter). The dorsal ground color is orangish yellow in the San Luis Valley, even lighter than the ssp. chusca (Edw.) (but chusca has a greater areal extent of its yellow orange color), but is darker yellow orange in the Arkansas River Canyon. The ventral surfaces are like ssp. sabuleti (the VHW has a complete pattern, unlike the washed out ssp. chusca which nearly lacks all pattern). It is limited to the San Luis Valley & Arkansas River Canyon in Colorado. Ssp. sabuleti occurs farther south along the Rio Grande in Taos Co. New Mexico, in NW New Mexico, and in western Colo. and the Great Basin. Types: 8 mi. W. Crestone, Saguache Co. Colo. J. Scott, 15 July 1970 male holotype, 8 m 10 f paratypes, 22 July 1971 3 f paratypes; 5 mi. W. Crestone, Saguache Co. Colo. 22 July 1971 allotype female, 5 m 21 f paratypes, J. Scott; ditch S. Great Sand Dunes Park, Alamosa Co. Colo. 17 June 1966 J. Scott & Juanita Scott 5 f; Moffat, Saguache Co. Colo. 25 June 1971 1 m J. Scott; Salida, Chaffee Co. Colo. 24 July 1974 1 f Glenn Scott; Hayden Creek, Fremont Co. Colo. 30 June to 6 Aug. 1970 to 1980, many paratypes J. Scott.

Poanes hobomok wetona Scott, new subspecies. Wetona is somewhat paler than P. hobomok hobomok (Harris). The brown DFW and DHW borders are slightly narrower, the dorsal wing bases have less brown, and the brown dorsal spot beyond the FW cell is smaller (less brown). Few females are as dark as ssp. hobomok, and many females are as light as males; the black female form pocahontas common in eastern U.S. in ssp. hobomok is absent in wetona. I first discovered wetona in 1967. It has since been found common throughout the foothills of the Wet Mts. in southern Colorado, and also on Raton Mesa in New Mexico. It possibly occurs between these areas, west of La Veta for instance. These are its only Rocky Mtn. localities (although ssp. hobomok occurs in the Black Hills). It occurs in Quercus gambellii-Pinus ponderosa habitat. Types: Sand Gulch S. Greenwood, 7200', Custer Co. Colo. 30 May 1971 Glenn Scott, holotype male, 4 m paratypes; North Creek 4 mi. NW Beulah, Custer Co. Colo. 29 June 1970 G. Scott 2 m 1 f, 30 June 1971 J. Scott, 11; Beulah, Pueblo Co. Colo. 12 June 1970 2 m J. Scott; 2 mi. up Greenhorn

Trail, Pueblo Co. Colo. 22 June 1967 1f J. Scott; Soda Gulch S. Wetmore, Custer Co. Colo. 7400' 29 June 1971 40 J. Scott; Smith Creek Campground, Custer Co. Colo. 25 May to 6 July, 1970-1973, 48, J. Scott & G. Scott; N. Hardscrabble Creek 2 mi. S. Greenwood, Custer Co. Colo. 24 June 1968 1 f G. Scott; slope between N. & middle Hardscrabble Creek, Custer Co. Colo. 30 June 1968 1 f G. Scott; N. Hardscrabble Crk. E. of Harms Gulch, Custer Co. Colo. 30 June 1968 2 m 3 f G. Scott; middle Hardscrabble Crk., Custer Co. Colo. 1 July 1968 1 f G. Scott; 2 mi. SW Oak Creek Cgd., Fremont Co. Colo. 7 July 1970 1 f J. Scott; 5 mi. SE Beulah, Pueblo Co. Colo. 18 June 1970 5 m G. Scott; South Hardscrabble Crk. 7400', Custer Co. Colo. 30 June 1971 8 J. Scott; N. of Goodpasture, Pueblo Co. Colo. 5 May 1972 1 m J. A. Scott; Raton Mesa, Colfax Co. New Mex. 4 July 1973 allotype female, 13 m 3 f paratypes J. Scott. 3 m paratypes to New Mex. State Univ., others to many colls.

Amblyscirtes simius Edw. form nigra and form rufa. Simius is quite variable on the upperside. It is the most variable Amblyscirtes except for A. aenus Edw. and its form erna Freeman. Males vary from blackish brown, with a few postmedian white forewing spots (form nigra) to half orange (the forewing with a strong band of pale orange, a small cell-end spot, and a submarginal-marginal wash of orangish tan, the hindwing with a postmedian orange band and a submarginal-marginal wash of orangish tan)(form rufa). Females vary from dark brown, the forewing with white dots in a postmedian row and a cell-end spot, the hindwing with a faint postmedian orangish band (form nigra), to form rufa with the white spots enlarged and turned orange, and broad orange areas from the postmedian forewing band to the tornus and from the middle to the margin of hindwing, and the basal regions are tan. The variation from nigra to rufa appears to be continuous, and males average somewhat darker than females. Both forms are found in the same localities in southern Colorado, and K. Roever finds them both in Arizona also.

Hylephila phyleus muertovalle Scott, new subspecies. Muertovalle differs from ssp. phyleus (Drury) in that adults are lighter. The males are only slightly lighter, but females are much lighter, being mostly orange dorsally rather than often dark brown in ssp. phyleus, and mostly ochre on VHW rather than dull olive yellow brown in phyleus. Females have wide dorsal postmedian bands of orange on both wings, plus the cell of both fore- and hindwings is largely orange and there is an orange streak along hindwing vein 2V. The female underside is largely orange in the VFW cell, largely ochre elsewhere except for a blackish rectangular blotch near VFW base, several brown submarginal VFW crescents, and median and submarginal brown crescents on VHW (which are faint in several females which have the VHW almost solid ochre). Ssp. muertovalle females are consistently light on upperside, frequently nearly spotless ochre on VHW, whereas ssp. phyleus females are often dark brown dorsally and usually olive yellow brown on VHW. The types are from Death Valley & vicinity and it may be limited to there. However most Calif. material seems fairly light, whereas females average darker along the Gulf Coast of SE U.S., so muertovalle possibly applies to the broader southwestern area. Types: Furnace Creek date grove, Death Valley, Inyo Co. Calif. 19 Sept. 1973 1 female holotype, 5 f paratypes (adults fly about Cynodon dactylon, the probable larval hostplant, in the date grove); NE Beatty, Nye Co. Nev. 19 Sept. 1973 1 male allotype; Las Vegas, Clark Co. Nev. 8 Aug. 1974 3 m paratypes.

Ochlodes sylvanoides bonnevilla Scott, new subspecies. Bonnevilla is the opposite extreme from santacruza, described next. The upperside is entirely yellow orange (even whitish orange in some females) in both sexes, except for a brown jagged border, the brown hind margin of both wings, the brown hindwing costa, the stigma (and the brown location where the stigma would be in the female), plus a brown streak just beyond the end of the cell. The underside is fairly uniformly yellow-orange (whitish ochre in many females) with a black patch on base of forewing, faint cream postmedian spots on both wings, with the forewing cell and adjacent costa pale orange. Bonnevilla differs from other ssp. in its

extreme pallidity, the underside even whitish in some females. It is limited to the Great Basin west and northwest of glacial Lake Bonneville as far as I know. It joins the growing list of butterflies that are extremely pale in that region. Types: Thomas Can., Ruby Mts., Elko Co. Nev. 25 Aug. 1966, holotype male, allotype female, & 19 m 18 f paratypes, J. Scott, 5 Aug. 1974 1 m paratype J. Scott; Shoshoni Falls, Twin Falls Idaho 24 Aug. 1966 4 m paratypes J. Scott; Twin Falls Idaho 4 Sept. 1973 1 m 1 f paratype J. Scott; Battle Mtn., Lander Co. Nev. 5 Aug. 1974 2 m 1 f paratypes J. Scott. Specimens from Ward Mine, White Pine Co. Nev. seem mostly referable to ssp. sylvanoides although several are like bonnevilla; Jett Can. Toiyabe Mts. Nev. has ssp. sylvanoides. 15 paratypes in J.R.Heitzman coll.

Ochlodes sylvanoides santacruza Scott, new subspecies. Santacruza has a dark often chocolate brown VHW with cream postmedian spots. The upperside is brown with distinct orange postmedian bands, several orange subapical DFW spots, and a broad orange band on the DFW costa and discal cell. The VFW has a black basal patch, a costal orange band like that of the upperside, several subapical cream spots, a postmedian pale orange band below the subapical spots fading to grayish cream near the tornus, the apical region reddish brown. The VHW is chocolate brown, the anal margin orange brown, with scattered bluish scales near the base and around the wing margins, and with cream (often yellow in males) postmedian spots in cells Sc + R_1 and R_5 in one spot, and in cells M_1, M_2, M_3, Cu_1, & Cu_2 in an oblique jagged band. Santacruza differs from ssp. sylvanoides in the darker chocolate brown VHW with its contrasting cream spots (dark brown with yellow spots in some males). Some populations along the California coast (darkest in Santa Cruz, Mendocino, & Humboldt Counties) have a brownish VHW with orange spots, and so are somewhat similar to santacruza. To settle the confusion regarding the identity of the subspecies of sylvanoides, I designate type localities for sylvanoides (Bdv.) 1852 as the Tuolumne gold fields, Tuolumne Co. Calif., and for both pratincola (Bdv.) 1852 and nemorum (Bdv.) 1852 I designate Broderick, Yolo Co. Calif. (first brood specimens)(see J. Tilden J. Lepid. Soc. 29:61 and A. Shapiro J. Res. Lepid. 13:138 concerning the last two names). These restrictions allow the ssp. to be safely applied as follows: santacruza applies to Santa Cruz Is. specimens, and possibly to the three counties along the Calif. coast cited above. Inland in the coast ranges occurs ssp. sylvanoides, which also occurs on the other Channel Islands and most of the west. On the Oregon Coast is the ssp. described next, and ssp. bonnevilla occupies part of the Great Basin in Nev. & S. Idaho and probably extreme NW Utah. Ssp. napa (Edwards) (type loc. Empire, Clear Creek Co. Colo.) is like sylvanoides so should probably be sunk as a synonym, although foothills specimens are slightly larger in the Colorado Front Range. Santacruza types: All Santa Cruz Is. Calif. Holotype male Central Valley 8 June 1966 R. Langston; allotype female Upper Central Valley 8 June 1966 J. A. Powell; Central Valley 7 June 1966 2 f J. Powell, 1 m R. Langston, 8 June 1966 1 m R. Langston; Upper Central Valley 9 June 1966 4 f J. Powell, 2 m R. Langston, 8 June 1966 1 m R. Langston; Prisoners Harbor Creek 7 June 1966 4 m 3 f J. Powell, 10 June 1966 1 f R. Langston; Christi Beach 30 April 1966 1 m J. Slater. The previous types are all in California Insect Survey; 35 other specimens therein are damaged and not made paratypes. Los Angeles County Museum paratypes: Central Valley 22-29 June 1979 6 f C. D. Nagano; Santa Cruz Is. 15 Aug. 1939 1 m L. Martin. It flies very early in the year.

Ochlodes sylvanoides orecoasta Scott, new subspecies. Orecoasta is characterized by its very dark upperside, the darkest in the species, in addition to the dark brown VHW, which has yellow spots. The marginal areas of DFW and DHW are darker than any other ssp. It is figured by Dornfeld (1980). Types: Cullaby Lake, Clatsop Co. Ore. 23 Aug. 1966 B. & S. Perkins, holotype male, allotype female, 1 m 1 f paratypes, holotype in LACM, others in J. Scott coll. 4 m 3 f paratypes from Beachside State Park S. Waldport, Lincoln Co. Ore. 3 Sept. 1963, E. Dornfeld, are slightly lighter than those from the TL. It also occurs at Yachats, Lincoln Co., and Cape Perpetua Forest Camp, Lane Co. Ore.

Pseudocopaeodes eunus alinea Scott, new subspecies. Alinea differs from P. eunus eunus (Edw.) in being more uniform bright fulvous in color above and beneath: the dark veins near the margins are nearly gone above and beneath, the brown patches on DFW are reduced in extent, and the VHW brown and white streaks are reduced & often nearly absent. Alinea is so distinct in appearance that one does not immediately identify it as P. eunus. The type locality of eunus is the Kern River bottoms near Bakersfield, Kern Co. Calif., and the type loc. of wrightii (Edw.) is "Mohave Desert" Calif. (F. Brown, Trans. Amer. Ent. Soc. 103:277-278). Brown figures the types of both, neither of which is like alinea. Alinea seems to be local in the central Mohave Desert near the type locality. Specimens from Inyo Co. Calif. have less well developed dark veins on VHW and are somewhat paler than specimens from San Diego Co. Calif., but both seem referable to ssp. eunus. The wrightii type has less well developed dark veins than the eunus type. I restrict the type locality of wrightii to near Victorville, San Bernardino Co. Calif., where Dr. John Emmel states it was undoubtedly collected. 7 m 13 f from Victorville in LACM are close to eunus although several females are like alinea; wrightii should be treated as a synonym of eunus. Types: Afton, San Bernardino Co. Calif. 9 Sept. 1965 O. Shields, holotype, 12 m 1 f paratypes (4 m paratypes in J. Scott coll., 5 m 1 f in J. R. Heitzman coll., all other types in LACM); Afton Can. 1300', 8 April 1961 O. Sette, 1 f paratype.

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Literature Cited

Dornfeld, E. J. 1980. The butterflies of Oregon. Timber Press, Forest Grove Ore.

Emmel, T., & J. Emmel 1973. The butterflies of southern California. Nat. History Museum of Los Angeles County. Science Series 26.

Fisher, M. 1977. The taxonomy & identity of Papilio nitra in Colorado. Bull. Allyn Mus. #47.

Goodpasture, C. 1973. Biology & systematics of the Plebejus acmon group. I. Review of the group. J. Kans. Ent. Soc. 46:468-485.

Scott, J. A. 1975a. Pyrgus xanthus: systematics, foodplants and behavior. J. Lepid. Soc. 29:213-220.

Scott, J. A. 1975b. Clinal intergradation of Hesperia comma colorado. J. Lepid. Soc. 29: 156-161.

Scott, J. 1978. A survey of valvae of Euphydryas chalcedona, E. c. colon, and E. c. anicia. J. Res. Lepid. 17:245-252.

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